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To: Stephen Coyle, Director

From: Gerry Kavanaugh, Eric Schmidt,
Bill McCarthy, Karen Gray

Date: August 16, 1989

Subject: Technopolis

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In preparation for the August 16th staff meeting on Technopolis, we have prepared some information for your review. Included are the following:

1. Technopolis Centers in Boston: Planning Rationale
2. Technopolis: Campaign to Institutions
3. Potential Technopolis Sites: Chart Summary
4. Overview: Current Boston Job Training Programs

Charts and related information regarding other research centers throughout the country are also being developed for your future review.

TECHNOPOLIS CENTERS IN BOSTON:

PLANNING RATIONALE

August 16, 1989

1. TECHNOPOLIS: A VISION FOR BOSTON'S FUTURE

The time has come for Boston to look to its great medical and educational institutions to generate a new economy based on medicine, biotechnology, pharmaceuticals, computer software, and high-technology. The timing of such an initiative is important, in part, because it represents a tremendous opportunity for Boston to capture leading-edge industries for long-term economic growth. It is also important because Boston's service economy, which, in recent years, has fueled record rates of business and personal income growth for the Boston metro region, may in fact grow at a slower rate in the future.

Boston's preeminence in medicine and higher education, and the many spin-off industries which have resulted from it, provide a rich and vital opportunity to diversify the region's economy in much the same way that financial, professional, and business services diversified what had been a dominantly manufacturing economy only a few decades ago. One measure of the potential for Boston's new economy is the region's national and international leadership in such fields as medical research, biotechnology, and computer software. Planned expansions and continuous innovations in these and other related fields suggest very promising prospects for Boston's future.

To both promote and facilitate the growth of Boston's new economy, the City of Boston has adopted the economic planning concept known as "Technopolis." Defined as a center of technology, the concept is already a key element in socio-

economic and industrial planning in other nations. Built around advanced-technology industries and the research functions that are essential to those industries, technopolises offer significant promise for promoting future economic growth through both increased productivity and employment.

At the heart of the technopolis concept is the existence of a synergistic relationship between private industry, academic institutions, and government. The physical proximity of these partners, the sharing of expertise, resources and personnel, and a climate of cross-fertilization for ideas, techniques and products are all key ingredients in the creation of this essential synergy. Numerous attributes and characteristics of the city of Boston and its regional economy suggest that this synergy is indeed attainable.

2. BOSTON'S STRENGTHS

In addition to the synergy essential to successful technopolis development, the siting of technopolis centers and implementation of the concept must be rooted in sound economic and physical planning practices. The following is an analysis of the strengths of Boston and its economy as they relate to the potential for development of technopolis centers:

a. Boston's Medical and Educational Institutions

The presence of many of the nation's leading medical and educational institutions in Boston has been and will continue to be a key factor in the development of new economies for the city and the metropolitan region. Boston is home to 31 hospitals -- some of them among the world's finest -- which together employ nearly 48,000 full-time workers at an annual payroll of over $1 billion. Of particular significance to the development of

technopolis centers, nine of the top eleven hospitals in research funded by the National Institute of Health (NIH) are located in Boston. As a result, Boston receives the highest per capita amount of NIH research funding of any city in the nation and, following New York City, the second highest amount of aggregate funding.

The city of Boston has 36 of the metropolitan area's 65 colleges and universities and an additional 26 career/technical schools. Among the many distinguished institutions are Northeastern University, the nation's largest private university, Boston University, the nation's fourth largest, and Harvard University's Medical, Dental, Public Health and Business Schools. Other world-renowned institutions, such as M.I.T. and Tufts University Medical School, provide much of the medical and scientific research and technological innovations upon which Boston's technopolis centers will build.

Over the next decade, the potential growth of Boston's medical and educational institutions is estimated to be in excess of eight million square feet of gross new development. With this development will come more than 22,000 employment opportunities for Boston area residents, more than 13,000 of which will be permanent employment positions. As a result, Boston's medical and educational institutions will, in the future, play an even greater role in the city's economy than they now do.

b. A Healthy and Diversified Local Economy

A second area of strength which augurs well for the technopolis concept in Boston is the overall health and diversification of the city's economy. Measured in any number of ways, Boston's economy has performed at record

levels for much of this decade. An average annual increase of 14,500 jobs between 1983 and 1987 has contributed to today's nearly "full employment" economy, with current unemployment rates among the lowest of any city in the country. Development activity in all sectors in Boston occurred at a pace of $1.4 billion per year between 1984 and 1988, totalling $6.8 billion for the period. The numerous public and private development projects currently underway or in the planning phase ensure that Boston will continue to generate fully one quarter of the entire Massachusetts economy (measured in tax revenue generation and economic output).

c. Availability of Land

The availability of developable land in Boston's urban core is a key factor in the city's technopolis planning strategy. Indeed, Boston has developable parcels throughout the city, the differing types of which lend themselves to various adaptations of the technopolis concept. In addition, the numerosity and variety of developable parcels, the proximity of several such parcels to medical research and academic institutions, mass transit, Logan Airport, and Downtown Boston enhance both their economic value and prestige as technopolis locations. Other sites offer the longer-term potential of self-contained campus settings for either R&D manufacturing development or the expansion of existing research and other activities.

d. Availability of Venture Capital

Boston's historic and continuing role as a center of finance and financial services contributes to the essential availability of venture capital and other forms of lending for technopolis and other types of investment. As the birthplace of both the mutual fund and the post World War II American

venture capital industry, Boston today manages more mutual fund money than any other city in the country and is home to more than 50 venture capital firms. In recent years, approximately one quarter of all U.S. venture capital investments have been made in the Boston area. The development of technopolis centers in Boston, while initially dependent on the availability of venture capital, will, in the future, create a solid and continuing basis for investment in R&D manufacturing and other commercial applications.

e. Infrastructure Investments

An additional strength which will have a direct impact on technopolis development in Boston is the level of current investment in public infrastructure improvements. The Central Artery/Third Harbor Tunnel Project and the Boston Harbor Cleanup Project represent a combined $10.3 billion in public investment. The depression of the Central Artery and construction of the Third Harbor Tunnel will result in major improvements in highway transportation and airport access. The harbor cleanup will have the indirect, though measurable, effect of further improving the quality of life in Boston. Together with planned expansion of the region's mass transit system, these public infrastructure improvements will both facilitate and enhance the development of technopolis centers.

f. Educated and Skilled Workforce

Tied in part to the presence of the region's many educational institutions, Boston is home to a very highly educated and skilled workforce. Boston's prestigious job market and high quality of life serve as strong inducements to college students from all over the country to remain after graduation. Innovative approaches to enhancing the employability of young and

disadvantaged individuals, including programs linking Boston hospitals and the city's public schools, are also taking place. Further enhancement and expansion of efforts such as these will help to provide the labor force necessary for the new jobs which Boston's technopolis centers will generate.

g. Progressive Governmental Policies

Governmental policies aimed at cultivating new and appropriate economic growth for Boston represent an important factor in the full realization of the potential of technopolis. Under the administration of Mayor Raymond L. Flynn, efforts to target new development away from the downtown core, the provision of incentives to encourage specific types of growth, and the strategic use of public land and resources have been key elements in Boston's economic success. In addition, through planning and zoning policies adopted by the Boston Redevelopment Authority, appropriate locations for diverse types of technopolis centers have been identified. Recent examples include the rezoning of the North and South Stations as Economic Development Areas where over 2 million square feet of "new economy" development will be cultivated through various zoning and development incentives. Continuation of these policies, as well as the adoption of the technopolis concept itself as a component of overall economic development policy, will assure Boston's long-term economic prosperity.

3. AN OPPORTUNITY TO DIVERSIFY BOSTON'S ECONOMY

A balanced and diversified economy comprised of complementary and mutually reinforcing activities, industries, and occupations enhances the success of

businesses, private individuals, and the quality of community life. Boston's exceptional success in capturing growth in the services-producing sectors of the national economy creates an opportunity for complementary advances in those manufacturing industries with the greatest potential for generating employment and "economic multiplier effects." In view of Boston's national and international stature in the medical and educational fields, local manufacturing industries most likely to enjoy a comparative advantage are those whose products and processes derive from medical and scientific research, as well as information-based technology. The development of technopolis centers will serve the dual purposes of facilitating state-of-the-art research and incubating R&D manufacturing applications, the results of which will be the long-term balancing and diversification of Boston's economy.

4. BENEFITS OF TECHNOPOLIS

In the broadest terms, the development of technopolis centers in Boston will ensure that the city retains -- and indeed enhances
-- its world-leader position in the fields of medical, biomedical, and scientific research well into the 21st century. As a result, present and future generations of Boston residents can expect to have outstanding employment opportunities and a quality of life standard matched by few other areas of the country or the world.

For research institutions and private corporations -- the key players in technopolis-based ventures -- the benefits of co-participation are numerous and significant. First, the combination and sharing of research and product application resources "under the same roof" will yield unprecedented economies of scale for all participants. Second, the continuous interaction of researchers and

private industry members will contribute to both planned and spontaneous "cross-fertilization" among medical and academic institutions, industry, and government research interests. Third, the working environment will provide optimal conditions for the growth of new manufacturing products and processes, as well as for high-quality "blue collar" jobs. Fourth, the selective location of technopolis centers will result in new "prestige locations" for industry and research organizations, as well as sources of cutting-edge jobs for in-demand professionals and college graduates. Fifth, in addition to contributing to greater diversification of Boston's economic base, the development of technopolis centers will also significantly add to local tax revenues.

5. IMPLEMENTATION OF TECHNOPOLIS

a. Future Technopolis Locations

Future technopolis locations within the city of Boston will cluster into three basic institutional/academic areas:

- To the west, the Longwood Medical Area provides a nucleus for the future expansion of biomedical research to proximate areas such as Parcel 18.
- To the south, Tufts University, the New England Medical Center (NEMC), and Boston University School of Medicine (University Hospital) are centers likely to expand into adjoining areas. South Station is the proximate expansion area for Tufts/NEMC; the Newmarket (including the proposed Boston Science Center) and SETSA sites are suitable locations for University Hospital expansion.
- To the north, Massachusetts General Hospital, the Massachusetts Eye and Ear Infirmary, and the M.I.T. Whitehead Institute are institutions with potential for future research expansion. The North Station Economic Development Area, Charlestown (including the Navy Yard and the former Hood site), and East Cambridge are the most proximate locations for this expansion.

The above locations offer premier sites for the expansion and relocation of existing institutions over the next twenty years. In addition, the locations

permit significant levels of growth to take place without creating adverse impacts upon surrounding neighborhoods.

In addition to these locations, other sites and parcels within the city offer the potential for development of campus-like, self-contained R&D manufacturing centers. These areas are typified by large tracts of vacant or underutilized land within Boston's residential neighborhoods, and, as a result, offer the potential for new employment centers for residents of those neighborhoods. Each of these sites has unique characteristics which allow large-scale investment and development opportunities similar to research and development parks created throughout the United States. Identified sites include:

- Fort Point Channel (South Boston)
- Cabot Yards (South Boston)
- Subaru Site (South Boston)
- Allston Landing (Allston-Brighton)
- Old Boston East (East Boston)
- Readville Yards (Hyde Park)
- Boston State Hospital (Mattapan)

b. Development Scenario: 1990-2010

The timetables presented below for the twenty-year development of technopolis centers and R&D manufacturing parks in Boston are based on several assumptions. The first assumption is that technopolis center development will occur at an average rate of 300,000* SF per year (as per estimate of A. Ganz). (*Total development could be higher over the twenty-year period if the initial years' growth precipitates accelerated growth in

later years.) Second, technopolis centers within the downtown will be developed as a result of existing institutional locations in the downtown and related investment- decision bases. Third, these manufacturing sites will be competitive with suburban (Route 128 or Worcester) sites. Fourth, it is assumed that specialty R&D manufacturing will occur only after sufficient technopolis development has occurred within the cluster areas. Fifth, overall buildout assumes a relatively uniform expansion of existing Boston institutions and attraction of several major outside manufacturers to the R&D Manufacturing Parks.

Timetables

Present Day:

South:	Boston Science Center	225,000 SF
North:	MGH at Chas. Navy Yard	300-400,000 SF
West:	Longwood Buildout (non-research)	1 million SF
	Total	± 1.6 million SF

1990-2000:

*Bio-tech Development only

South:	South Station Air Rts.	1 million SF
North:	MGH North Station Parcel	800,000-1 million SF
West:	Parcel 18	500,000 SF
	Total	± 2.4 million SF*

2000-2010:

**Assume 2 of three sites developed - bio tech only

South:	Newmarket/SETSA	1 million SF
North:	East Cambridge/MIT	1 million SF
West:	Parcel 18 (completion)	1 million SF
	Total	2 million SF**

2000-2010 R&D Manufacturing Parks:

***Assume 3 of 7 sites are developed

Fort Point Channel	
Cabot Yards	
Subaru	
Allston Landing	
Old Boston East	
Readville	
Boston State Hospital	
Total	4.5 million SF*** (approximation)

Cumulative/Yearly Development Totals:

Technopolis Sites:

1990-2010:	6 million SF
Yearly Average:	300,000 SF

R&D Mfg. Parks:

2000-2010:	4.5 million SF
Yearly Average:	450,000 SF

c. Prototypical Technopolis Center Development Timeframe:

- o RFQ to Tentative Developer Designation: 4-6 months
- o Designation to Development Approval: 6-12 months
- o Design Drawings: 12-18 months
- o Construction: 18-24 months

Avg. Project Total Time: 4 years

TECHNOPOLIS CENTERS

CAMPAIGN TO INSTITUTIONS

The City's major institutions - both medical and educational - can play a major role in the development of the City's Technopolis Centers. Boston University, Northeastern University, Harvard Medical School, Massachusetts General Hospital, Beth Israel Hospital, Brigham and Women's Hospital, and other Boston institutions are major participants nationally and internationally in their respective fields, and can be vitally important to such an initiative.

In addition, many of our major institutions have geographical proximity to defined Technopolis sites. The proximity of Mass. General Hospital and Mass. Eye and Ear Infirmary to the Charlestown Navy Yard and North Station, of New England Medical Center, Tufts University, and Boston University Medical School to South Station, Cabot Yards, and Fort Point Channel, and of the Longwood Medical Area to Parcel 18, are primary examples of this advantageous geography.

These and other major institutions are also planning major expansion projects over the next decade. According to recent Institutional Master Plan, more than 8 million gross square feet of new or renovated space will be produced over the next ten years. With this new square footage, new jobs and enhanced services for Boston and its economy will be created. However, with such development there may also be negative impacts -- upon the institutions themselves, and their surrounding communities. These impacts upon our traffic and circulation systems, parking facilities, the environment, open space, and quality of life in the surrounding area must be fully recognized, addressed, and, to the extent possible, mitigated.

As this development is planned, as Institutional Master Plans are reviewed, and as the City and its institutions work toward the expansion of this vital local economy, there must be a cooperative effort to set overall parameters, limits, and guidelines for growth which the City and institutions can utilize to guide future development. Concurrently, the City and institutions, both cognizant of such parameters, must look to new off-site locational opportunities for development which will allow growth and its positive benefits to take place without the negative impacts of currently planned, on-site growth. The city's proposed Technopolis Centers can provide the opportunities for such growth to take place.

A primary example of such a process already implemented is the Mass. General Hospital's development of research space in the Charlestown Navy Yard. Mass. General has already leased 392,000 square feet of space, and is now finalizing the purchase of 650,000 square feet of such space.

An example of a geographical area where master planning is now taking place which may result in similar decisions is the Longwood Medical Area. A master planning process, initiated cooperatively by the BRA and the Medical Area Service Corporation (MASCO), will begin to set forth a program for future growth which will define impacts of planned growth, set standards and parameters for expansion based upon defined impacts, and identify opportunities for off-site development at one or more potential Technopolis sites.

In addition to these specific efforts, the planning process with institutions

regarding the development of Technopolis sites will include the following sets of actions:

1. Education - As the BRA works with all of the City's institutions, an effort will be made to ensure that each institution is aware of the impacts of its planned growth upon its own environment, as well as that of surrounding areas, and of possible off-site development opportunities.

2. Master Planning - As Institutional Master Plans are reviewed, institutions will be required to address the impacts of their proposed development, and with BRA staff assistance, begin to analyze prospective growth standards and parameters beyond which expansion cannot continue on-site. Concurrently, institutions will begin to plan for potential off-site development through analyses of the Technopolis sites. (We have already begun to work with several institutions regarding Technopolis siting through their Master Plan reviews, and will continue to do so.)

3. Technopolis Benefits - The benefits to the City's major institutions of developing space at Technopolis sites must be fully defined, stated, and presented. The financial benefits, in particular, must be adequately detailed.

4. Area-Wide Master Planning - As Institutional Master Plans are reviewed, master planning must take place for specific geographical areas within which more than one (1) institution is located. The Longwood Medical Area is a primary example of an area where such planning is taking place at the present time. In the Chinatown/South Cove area, the same type of area-

wide master planning must take place as the New England Medical Center and Tufts University Master Plans are developed. In all appropriate geographical areas, assessments of cumulative impacts must take place to determine the relative appropriateness of on-site and off-site types of development.

5. Institutional Master Plan Zoning Amendment - As the Institutional Master Plan Zoning Amendment is developed and reviewed, language must be included which requires a commitment to address the feasibility of locating space at Technopolis sites, and its potential as an opportunity to grow without negative impacts.

6. Institutional Project Reviews - As individual institutional projects proceed through the Article 31 process, the institution and BRA must work cooperatively to: (1) measure the impacts of the proposed project; (2) analyze functions and uses of the proposed project the existing campus; (3) assess off-site relocation potential to reduce cumulative impacts of growth; and (4) cooperatively mitigate impacts so that a proposed project can move forward while Technopolis objectives are being achieved. To the extent that such analyses initially take place during the Master Plan review process, proposed projects will have addressed the issues of cumulative impacts and possible off-site development prior to the project review stage.

With the significant need for and high costs of job training faced by all of the city's major hospitals, it should be noted that any efforts to assist in such matters at Technopolis sites would be very favorably received by the

institutions. For example, a job training center at any of the Technopolis sites would be a positive incentive for an institution to locate there. This thought has already been conveyed to the Parcel 18 representatives.

Potential Technopolis Sites: Chart Summary

A chart is being developed which defines and analyzes potential Technopolis sites according to a specific set of criteria which have been prescribed as vitally important to the development of Technopolis centers. The criteria include the following:

1) Location
2) Size
3) Ownership
4) Zoning
5) Auto Access
6) Transit Access
7) Airport Access
8) Proximity to Institutions
9) Surrounding Uses

The evaluated sites have been broken down into three (3) tiers of potential attractiveness for the development of Technopolis centers. They are:

1st Tier

Parcel 18

2nd Tier

SETSA

Cabot Yards

Allston Landing

Hood

NPZ9/29.RPT
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3rd Tier

Readville

Old Boston East

Boston State Hospital

Subaru

South Station, North Station, and the Charlestown Navy Yard have not been evaluated, but it can be assumed that they would be in the 1st Tier grouping with Parcel 18.

Our assessment would also suggest that some of the 2nd and 3rd Tier sites might be most appropriately suited for R&D manufacturing.

OVERVIEW:

CURRENT BOSTON JOB TRAINING PROGRAMS

Current job training efforts in Boston focus on high school students and unemployed, low-income adults. While many of these programs are funded by the Mayor's Office of Jobs and Community Service (JCS) and/or EDIC, several new job training efforts have been created in response to linkage requirements. A brief description of the City's major training programs is provided below.

Boston Technical Center. The Boston Technical Center, which is run by EDIC and funded in part by JCS, provides job training for low-income or unemployed adults in four occupational areas: (1) Business Skills - training in computers, word processing, accounting and general keyboard skills; (2) Technical Skills - training in business machine repair and electronics; (3) Construction and Culinary Arts - short internships in cooking and carpentry at local hotels and construction sites; and (4) Health Careers - training in patient care, medical billing, central supply, and medical technician skills.

These programs average between 20 and 24 weeks in length and involve approximately 35 hours of classroom participation per week. While many of the programs are limited solely to classroom instruction, some try to simulate the work environment and/or provide internships for the participants. Approximately 3,000 people graduate from the Technical Center job training programs each year. Currently, the demand for Boston Technical Center training is greater than program capacity.

Humphrey Occupational Resource Center. The Humphrey Occupational Resource Center (HORC) runs vocational job training programs for high school students primarily from the Roxbury area. This program is designed to prepare teenagers for technical skill oriented careers after graduation from high school. In recent years, however, the HORC has experienced serious enrollment and drop-out problems and currently operates at a below-capacity level.

In addition to Boston Technical Center and HORC programs, the JCS also funds approximately 12 smaller job training programs throughout the City's neighborhoods.

Children's Hospital. In response to a linkage (DIPP) agreement requiring a contribution to the Neighborhood Job Trust, the Children's Hospital, in a collaborative effort with Boston English High School, created a job training program for at-risk students. This program provides the students with an opportunity to combine work experiences at Children's with specially structured classes that teach real world "survival skills".

The program consists of a two-year sequence in which, during year one twenty Junior year students participate in a "career options" class and paid field internships in occupational areas which have historically experienced difficulty in securing qualified entry level candidates. During the summer the students are encouraged to accept part-time positions at the hospital. In year two, returning students, now seniors, continue the internships and the class with a new focus on skills training and work adjustment issues, and a second group of juniors begin

the first year of their program. Upon successful completion of the program, the participants are offered permanent full-time positions at Children's Hospital.

Beth Israel Hospital. Beth Israel Hospital operates a six-week summer internship program which places a diverse group of high school students in various volunteer positions throughout the hospital. Participants are recruited through high school guidance councilors and have a wide range of abilities and interests. Several of the students are encouraged to pursue careers in nursing. While approximately 30 students participate in the Beth Israel program each summer, several youths remain on a waiting list.

In addition to these full-year programs, hospitals such the New england Medical Center (NEMC) and Brigham and Womens have summer employment programs of various types. NEMC, for example, hires approximately 18 Chinatown high school students during the summer, while Brigham and Womens hires approximately 20 students through the the Private Industry Council's (PIC) Summer Youth Employment Program. Working with the PIC, Brigham and Womens has also developed a formal partnership with the Grover Cleveland Middle School, through which students are introduced to halth care careers via tours of the hospital and school visits.

Boston City Hospital Employees

It is worthwhile to note that Boston City Hospital and the Department of Health and Hospitals has begun to pursue the retraining and/or placement of BCH employees to be laid off in upcoming years. These employees, if appropriately retrained, could assist the city's medical institutions in addressing their labor

shortages. In turn, the city's hospitals could provide new employment opportunities for BCH employees. The true potential for this mutual-benefit opportunity is presently being explored with the city's hospital community.

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